ATTACHMENTS

Provided herewith is a declaration of inventor Ali Kaan Kalkan provided under 37 CFR 1.132.

REMARKS

This response is submitted to be fully responsive to the final Office Action embodied in Paper No. 20091022. In addition to the remarks provided, a declaration of Dr. Kalkan provides additional explanation as to why nanowires coated with magnetic material that in turn is coated with metallic nanoparticles would not support surface plasmon resonance in those nanoparticles. Claims 105 and 107-111 remain rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement on the basis that the phrase "wherein one of said plurality of metallic nanocrystals bridges two spatially separated adjacent columns of said array of nanostructured silicon columns" is found to lack support in the original filed specification. Claims 99 and 102-104 remain rejected under 35 U.S.C. §102(e) as anticipated by, or in the alternative under 35 U.S.C. §103(a) over Filas et al. Claim 100 stands rejected under 35 U.S.C. §103(a) over Filas et al. in view of Debe. Claims 99-102 and 104 are believed to stand newly rejected under 35 U.S.C. §103(a) over Debe only to the extent that Debe teaches platinum nanocrystals (based on Office Action remarks found on pages 5-7 and 13-14). Lastly, claims 99 and 101-104 stand rejected under 35 U.S.C. §103(a) over Sun et al. in view of Zang et al. All of the references currently used as part of the prior art rejection are of record. Reconsideration and withdrawal these rejections is requested based on the following remarks and the attached declaration.

Remarks Directed to Rejection of Claims 105 and 107-111 under 35 U.S.C. §112, First Paragraph

In support of the offending claim language, provided with the attached declaration is a better quality SEM micrograph corresponding to the 90 second substrate exposure to silver ion solution of originally filed Figure 6. Based on the reference bar in the lower right-hand corner of the micrograph representing 100 nanometers, silver nanoparticles as large as 80 nanometers (bright dots in micrograph) are observed on top of the nanocolumnar array. Given that the average column diameter and separation are both 20 nanometers, it is submitted that an 80 nanometer particle must necessarily span at least two columns. In addition to this experimental data supporting this claim recitation, the Examiner's attention is again directed to paragraph [0049] of U.S. Patent Application Publication US 2006/0141268 corresponding to the above-referenced application and in particular the sentence that states "Since there is no constraint on particle size on the top surface of the film, Ag nanoparticles occupying that position on the void-column film may, with additional exposure, grow to the order of the wavelength of light in the visible range [hundreds of nanometers]." Assuming a shortest visible light wavelength of 440 nanometers and the same substrate of nanocolumns-voids depicted in Fig. 6, then a 440 nanometer particle would span in a linear direction 11 nanocolumns. The standard for written description under 35 U.S.C. §112, first paragraph, is stated in MPEP §2163 as:

> To satisfy the written description requirement, a patent specification must describe the claimed invention in sufficient detail that one skilled in the art can reasonably conclude that the inventor had possession of the claimed invention. See, e.g., *Moba, B.V. v. Diamond Automation, Inc.*, 325 F.3d 1306, 1319, 66 USPQ2d 1429, 1438 (Fed. Cir. 2003); *Vas-Cath, Inc. v. Mahurkar*, 935 F.2d at 1563, 19 USPQ2d at 1116. Possession may be shown in a variety of ways including by describing distinguishing identifying characteristics sufficient to show that the applicant was in possession of the claimed invention. See, e.g., *Pfaff v. Wells*

> *Elecs., Inc.*, 525 U.S. 55, 68, 119 S.Ct. 304, 312, 48 USPQ2d 1641, 1647 (1998); *Eli Lilly*, 119 F.3d at 1568, 43 USPQ2d at 1406; *Amgen, Inc. v. Chugai Pharmaceutical*, 927 F.2d 1200, 1206, 18 USPQ2d 1016, 1021 (Fed. Cir. 1991) (one must define a compound by "whatever characteristics sufficiently distinguish it"). An original claim is adequately described if all critical elements of the claim are described in the specification, are conventional in the art, or are known to one of ordinary skill in the art.

Applying standards for compliance with the written description requirements to the pending claims, it is submitted that experimental data showing an 80 nanometer particle residing on a substrate of 20 nanometer nanocolumns separated by 20 nanometer voids provides experimental evidence of the actual production of the invention commensurate in scope with that claim. The additional language found in paragraph [0049] detailed above recognizes that retaining the substrate in the metal ion solution for longer than 90 seconds allows one to grow particles of approximately an order of magnitude greater size that in effect span in a linear direction at least ten such nanocolumns.

Based on these remarks, it is respectfully submitted that one skilled in the art would have to conclude that the inventor had actual possession of the claimed invention and therefore the written description requirements under 35 U.S.C. §112, first paragraph, have been satisfied. Reconsideration and withdrawal of this rejection are therefore requested. With the withdrawal of this rejection, claims 105 and 107-111 are noted to be free of rejection and in allowable form, or in the case of claim 105, at least directed to patentable subject matter even if rejections persist with respect to base claim 99.

Remarks Directed to Rejection of Claims 99 and 102-104 under 35 U.S.C. §102(e) or in the Alternative under 35 U.S.C. §103(a) over Filas et al.

The basis of this rejection is that silicon or semiconductor nanowires (diameter between 0.5 and 50 nanometers and a length greater than 100 nanometers) are coated with magnetic material and then aligned orthogonal to a substrate. Subsequently, a liquid carrier including already formed metallic nanoparticles is introduced and optionally subjected to subsequent decomposition, sintering, or cure. (Paper No. 20091022, page 3, second paragraph).

The basis of the rejection is that metallic nanoparticles of Filas et al. contact with a magnetic intermediate material overlying the nanowires would be expected to exhibit surface plasmon resonance on the basis of inherency. As to the rejection under 35 U.S.C. §103(a), reliance is placed on the teaching of *In re Best* and *In re Spata*.

The attached declaration provides additional evidence as to nature of surface plasmon resonance and why surface plasmon resonance would not be supported in structures produced by Filas et al. In addition to the evidence of patentability as to the claimed invention relative to Filas et al. provided through the declaration, it is respectfully submitted that statements already of record (amendment of July 22, 2009, pages 9-10) were entitled to consideration as representing a scientifically verifiable statement implicitly sworn to by signature of Applicant's representative. As such, the failure to provide consideration to this statement is respectfully submitted to have been improper.

The recitation found in pending independent claim 99 as to the "plurality of metallic nanocrystals exhibiting surface plasmon resonance" imparts a structural aspect to the pending claims in that any inclusions or modifications of an inventive composition that preclude surface plasmon resonance from metallic nanocrystals is excluded from the claim. As Filas et al.

admittedly lacks a teaching as to metallic nanocrystals exhibiting surface plasmon resonance, the only basis for rejection under 35 U.S.C. §102(c) is inherency (*ibid*, page 4). The law of inherency anticipation is quite clear in that it is not enough for a reference to possibly contain the missing descriptive element, but rather the missing claimed recitation must necessarily be present. In *Rosco Inc. v. Mirror Lite Co.*, 64 USPQ2d 1676, 1680, the court has stated:

> Under the doctrine of inherency, if an element is not expressly disclosed in a prior art reference, the reference will still be deemed to anticipate a subsequent claim if the missing element "is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill." *Cont'l Can Co. v. Monsanto Co.*, 948 F.2d 1264, 1268, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991). "Inherent anticipation requires that the missing descriptive material is 'necessarily present,' not merely probably or possibly present, in the prior art." *Trintec Indus., Inc. v. Top-U.S.A. Corp.*, 295 F.3d 1292, 1295, 63 USPQ2d 1597, 1599 (Fed. Cir. 2002) (quoting *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999)).

It is respectfully submitted that a finding that the nanoparticles of Filas et al. are of the same material and uniformly dispersed, while ignoring the fact that these nanoparticles are in contact with an electrically conductive magnetic material is submitted to represent a basis for rejection that is inconsistent with the known physics of surface plasmon resonance as well as the legal standards of inherency. Reference is again made to the attached declaration in support of this position.

In light of the above remarks and attached declaration, pending claims 99 and 102-104 are submitted to be novel over Filas et al. Reconsideration of withdrawal of the rejection of those claims under 35 U.S.C. §102(e) as anticipated by Filas is therefore requested.

As noted in the attached declaration and the remarks of record, the magnetic coating on which the metal nanoparticles of Filas are deposited is expected to effectively quench surface

plasmon resonance from the metal nanoparticles. On this basis alone, the *prima facie* case of obviousness of record is submitted to have been rebutted. Additionally, it is noted that the magnetic coating applied to the nanowires of Filas et al. is essential to align the nanowires on a surface (column 11, lines 16-19). Assuming for argument's sake that one were to propose exclusion of the magnetic coating Filas et al., such a proposed modification would render Filas et al. unsatisfactory for its intended purpose as nanowire alignment would not occur thereby rendering Filas et al. hypothetically unsuitable for its intended use. This hypothetical change would be improper consistent with the holdings in *In re Gordon*, 733 F.2d 90, 221 USPQ 1125 (Fed. Cir. 1984).

Additionally, it is noted that nanoscale particles of metal or metal precursor of Filas et al. (reference numeral 30) do not **uniformly** space between the columns of the array of nanostructured silicon columns as recited in pending independent claim 99 but rather form a settled mass preferentially around the base of the magnetically coated nanowires. This is submitted to represent a separate basis for the allowability of claim 99 and those claims that depend therefrom over Filas et al.

In light of the attached declaration and the above remarks, reconsideration and withdrawal of rejection as to claims 99 and 102-104 under 35 U.S.C. §103(a) is requested.

Remarks Directed to Rejection of Claim 100 under
35 U.S.C. §103(a) over Fila et al. in View of Debe

Applicant hereby incorporates by reference the remarks made of record with respect to this rejection.

Remarks Directed to Rejection of
Claim 101 under 35 U.S.C. §103(a) over Filas et al.

The basis of this rejection is that while Filas et al. is silent as to specific spacing dimension, adjustment of such would have been a mere discovery of an optimum value.

Reconsideration of this rejection is requested on the basis of dependency from claim 99, now believed to be in allowable form on the basis of the above remarks.

In light of the above remarks, reconsideration and withdrawal of the rejection as to claim 101 under 35 U.S.C. §103(a) over Filas et al. is requested.

Remarks Directed to Rejection of
Claims 99-102 and 104 under 35 U.S.C. §103(a) over Debe

With respect to this rejection, Applicant hereby incorporates the remarks previously made of record on July 22, 2009 on pages 12-15 as continuing to be relevant. Additionally, the finding in the outstanding Office Action at page 6 that Figure 2b of Debe shows uniform covering of isolated nanocrystals of platinum is in direct contradiction to statements found in Debe at column 14, lines 11-37 that specifically recite that the coatings are conformal and with non-uniform distribution along the lengths of the microstructures (lines 13-14) indicating a greater coating density at the microstructure tops relative to the bases for Figs. 2a-2c [including Fig. 2b] (lines 14-17), as well as low energy work function sites including multiple facets and grain boundaries (lines 35-36) that are thought to be beneficial for enhanced electron field emission. To modify a device of Debe to provide uniformly dispersed metal nanoparticles is respectfully submitted simply to not be taught in Debe while the claimed recitation that the metal nanoparticles exhibit surface plasmon resonance is respectfully submitted to render Debe unsuitable for its intended use in enhanced electron field emission. *In re Gordon* (*supra*). The attached declaration also makes note of this difference.

In light of the remarks of record and those provided above, reconsideration and withdrawal of the rejection as to claims 99-102 and 104 under 35 U.S.C. §103(a) over Debe is requested.

Remarks Directed to Rejection of Claims 99 and 101-104 under 35 U.S.C. §103(a) over Sun et al. in View of Zhang

The basis of this rejection is that Sun teaches a method of making metal nanoparticles using silicon nanowires to reduce metal salt solutions so as to deposit the nanoparticles onto the nanowires as detailed with respect to the anticipation rejection "Sun uses SiNW's that are fabricated by laser ablation techniques. Sun does not teach a technique that will result in a densely packed array of SiNW's." (Paper No. 20091022, page 8, first paragraph).

Zhang et al. is cited to bolster this deficiency of Sun et al. in providing a methodology that grows silicon nanowires of a higher density with equal weight, uniform diameter, and perpendicular growth (*Ibid*, paragraph 2).

The basis of the rejection is that a routineer in the art would simply replace the freestanding silicon nanowires of Sun with the dense array of nanowires provided by Zhang et al. to "allow for more sites of reduction of metal salt to metal nanoparticles as taught by Sun." (*Ibid*, paragraph 3), with the motivation of such being a predictable result of yielding more nucleation sites for reduced metal nanoparticles and better control of diameters size (*Ibid*, page 5, first paragraph).

It is respectfully submitted that a routineer in the art would recognize several differences between silicon nanowires taught in Sun et al. and Zhang et al. that at best invite a research project without a likelihood of success. Applicant's position is further bolstered by the attached declaration.

While both Sun et al. and Zhang et al. use the same term of "silicon nanowires", the resultant silicon nanowires are not structurally equivalent. For example, the silicon nanowires of Sun et al. are polycrystalline (page 6396, column 2, first full paragraph) while the silicon nanowires of Zhang et al. are single crystal (see title). Additionally, it is of note that the silicon nanowire surfaces of Sun et al. appear to be smooth and indeed would be expected to be so based on a laser ablation synthesis technique while those of Zhang et al. are not smooth (page 1293, column 2, first full paragraph). Based on these differences, it is submitted that one of ordinary skill in the art would appreciate that if one attempted to grow metal nanoparticles from solution on a single crystal silicon nanowire according to Zhang et al., that the various surfaces of single crystal silicon are well known to have different surface energies and growth kinetics resulting in metal nanocrystals preferentially populating certain facets of the single crystal nanowire relative to other faces. These differential metal nanoparticle growth rates based on the various energy faces of a single crystal silicon nanowire according to the prior art reference combination teach away from the claimed invention with respect to a "plurality of metallic nanoparticles spaced uniformly between columns of said array of nanostructured silicon columns." As such, independent claim 99 is submitted to be patentably distinct over the combination of Sun et al. and Zhang et al. Dependent claims 101-104 which depend from claim 99, now believed to be in allowable form, are likewise submitted to be directed to patentable subject matter distinct from dependency from claim 99. Applicant reserves the right to make of record such remarks in furtherance of the separate patentability of these dependent claims in due course of prosecution in the event that this rejection is maintained.

In light of the above remarks and the attached declaration, reconsideration and withdrawal of the rejection as to claims 99 and 101-104 under 35 U.S.C. §103(a) over Sun et al. in view of Zhang et al. is requested.

Summary

Claims 99-105 and 107-110 remain pending in the application. Each claim is believed to be in allowable form and directed to patentable subject matter. Reconsideration and withdrawal of the outstanding rejections and the passing of this application to issuance are solicited. Should the Examiner have any suggestion as to how to improve the form of any of the pending claims, it is respectfully requested that the undersigned attorney in charge of this application be contacted at the telephone number given below.

The Director is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account No. 07-1180.

Dated: 28 December 2009

Respectfully submitted,

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